

the alternative, the second process 34 can be another form of predictive text entry system or some other process configured to provide additional functionality to the user in association with the first process 30 or to another process operative in connection with the second process 34 in response to redirection of the user input stream 24.

[0045] Redirecting the user input stream 24 to the second process 34 in response to the first predefined input key event for at least the predetermined time period  $T_1$  enables the input management system 20 to provide an adaptive interface for enhancing the functionality of the first process 30 with functionality provided by the second process 34. Alternatively, the redirection mechanism provided by the input management system 20 can be used to invoke one or more other processes to enhance the functionality of the first process 30 or another process available on or through the personal computing device 10. The redirection mechanism of the input management system 20 is described in further detail below.

[0046] In the first embodiment, once the user input stream 24 has been redirected to the second process 34, the input management system 20 monitors the user input stream 24 for an occurrence of a second predefined input key event associated with further redirecting the user input stream 24. In response to identifying the occurrence of the second predefined input key event, the input management system 20 redirects the user input stream 24 to either the first process 30 or another process. In the case of the first embodiment, the input management system 20 redirects the user input stream 24 back to the first process 30.

#### Input Key Events and Keyboard-Type Input

[0047] Input key events associated with user operation of the keyboard-type device 14 are communicated to the applicable process via the operating system 22. An input key event represents an event associated with a particular key or set of keys supported by the keyboard-type device 14. In general, an input key event is associated with user selection or deselection of a key or set of keys available the keyboard-type device 14. For example, selection of a particular key on the keyboard-type device 14 represents one input key event, and deselection of the selected key represents another input key event. Selection of a particular key for at least predefined period of time  $T_1$  represents another input key event associated with user operation of the keyboard-type device 14. Input key events are used by the input management system 20 to manage the direction of the user input stream 24 and to determine which process or set of processes will receive the user input stream 24 in response to or during a particular input key event or set of input key events.

[0048] As mentioned earlier, in the first embodiment the keyboard-type device 14 is preferably a keyboard 14.1. In this case, keyboard input is received from the keyboard 14.1 by the personal computing device 10 in the form of input key events (in this embodiment, also referred to as keyboard events) which are processed by the operating system 22. Preferably, keyboard input is received by the operating system 22 via a keyboard device driver that receives scan codes from the keyboard 14.1. The scan codes represent identifiers associated with the respective keys on the keyboard 14.1. Each key on the keyboard 14.1 preferably has a unique scan code value associated with it. The mechanism by which scan codes are implemented can be device dependent

and therefore the keyboard device driver applicable to the keyboard 14.1 device in use provides a mechanism for receiving scan codes from the applicable keyboard 14.1 and for having the scan codes translated into virtual key codes recognizable by the operating system 22. Keyboard device drivers and their use in connection with keyboard devices are well known in the art.

[0049] In the first embodiment, where the operating system 22 is Windows XP™, the keyboard device driver interprets a scan code and translates it into a virtual key code which is a device independent value defined by the operating system 22 that identifies the purpose of a key. The keyboard 14.1 generates two scan codes when a user selects a key on the keyboard 14.1. One scan code is generated when the user selects the key and another is generated when the user deselects the key.

#### System Level Focus for Keyboard Input

[0050] Keyboard input received from the keyboard 14.1 is communicated via the operating system 22 to the process that has the keyboard focus. The keyboard focus is used as a mechanism for determining which process is currently assigned to receive keyboard input. The keyboard focus can be set to a particular process using the commands available with the applicable operating system 22. For example, with Windows XP™ the keyboard focus can be given to one of the applications (or windows) preferably by calling the SetFocus function and the AttachThreadInput function available with the Windows XP™ operating system. With Windows XP™ a window can be made active and brought to the foreground in the graphical user interface by setting the window using the SetActiveWindow and SetForegroundWindow functions provided by Windows XP™. In the first embodiment, keyboard input received from the keyboard 14.1 is translated by the operating system 22 and posted as a keyboard message to a message queue of the thread that created the window with the keyboard focus. Eventually, the keyboard message is removed from the message queue and passed to the appropriate window procedure of the window with the keyboard focus. This form of keyboard focus is well known in the art and is referred to in this specification as operating system-level keyboard focus. More generally, the term “system-level input focus” is used in this specification to refer to the assignment of input received from a keyboard-type device to a process through functionality provided by the operating system (such as through a programmable interface or API available with the operating system). System-level input focus includes the operating system-level keyboard focus described above.

[0051] In the first embodiment, the operating system 22 shares the keyboard 14.1 among the various processes running within the operating system 22 (where these processes are represented in the first embodiment as windows applications running within Windows XP™), by shifting the keyboard focus from one window (process) to another window (process) at the user's direction. The window that has the keyboard focus receives the keyboard messages from the user input stream 24 until the keyboard focus changes to a different window. The keyboard focus can be shifted from one window (process) to another window (process) through a variety of activities including, but not limited to, the user opening a new application using the keyboard 14.1, a mouse or another human input device; by the user shifting keyboard